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Utilizing the Context of *Batik Parang Teja* in Developing Teaching Materials Supported by Desmos Classroom on Translation and Reflection Topic

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Abstract. Integrating the culture around students environtment into mathematics learning can make learning more innovative, interesting, contextual and meaningful. This research aims to develop translation and reflection teaching materials assisted by Desmos Classroom by utilizing the Batik Parang Teja context. Teaching materials were developed using the ADDIE development model. The research stages include conducting literature review, designing teaching materials, improving its quality based on expert input, applying teaching materials in classroom, and evaluating the quality of the teaching materials developed. The data of the product quality are collected through validation sheets by experts. Based on experts judgement, the Desmos Classroom-assisted teaching materials developed being suitable for use in mathematics learning, especially translation and reflection topic.

Keywords: Batik Craft; Desmos Classroom; Ethnomathematics; Translation and Reflection

Abstrak. Pengintegrasian budaya di sekitar lingkungan siswa ke dalam pembelajaran matematika dapat menjadikan pembelajaran lebih inovatif, menarik, kontekstual dan bermakna. Penelitian ini bertujuan untuk mengembangkan bahan ajar materi translasi dan refleksi berbantuan Desmos Classroom dengan memanfaatkan konteks Batik Parang Teja. Bahan ajar dikembangkan dengan menggunakan model pengembangan ADDIE. Tahapan penelitian meliputi melakukan tinjauan pustaka, merancang bahan ajar, meningkatkan kualitasnya berdasarkan masukan para ahli, menerapkan bahan ajar di kelas, dan mengevaluasi kualitas bahan ajar yang dikembangkan. Data kualitas produk dikumpulkan melalui lembar validasi oleh para ahli. Berdasarkan penilaian ahli, bahan ajar berbantuan Desmos Classroom yang dikembangkan layak digunakan dalam pembelajaran matematika khususnya topik translasi dan refleksi.

Kata kunci: Desmos Classroom; Etnomatematika; Kerajinan Batik; Translasi dan Refleksi

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INTRODUCTION

Education and culture are closely related to human life, culture is one aspect of life that is inherent in society and education is an important need for every individual. Through culture-based learning, students do not just imitate and or just receive information delivered, but students create meaning, understanding, and meaning from the information they get (Akmalia et al., 2023). Teachers need to prepare a structured learning process that is effective and learner-centered (Cai et al., 2009). The structured learning process is important for all learning subjects, especially mathematics. Mathematics is a subject that requires deep understanding so learning must be structured. In general, learning in schools is still centered on teachers who directly provide formulas and example problems, then students do exercises without the opportunity to be creative or actively participate (Suandito, 2017). This makes students less deepen the concept. A real example of the problem of concept understanding that is lacking has been stated in previous research which states that students generally have difficulty in understanding transformation material, namely finding concepts well (Maulani & Zanthy, 2020).

Based on previous research, contextual learning methods and approaches have a significant effect on mastery of mathematical concepts (Lutvaidah, 2016). The contextual approach is an approach that provides comfort for students in learning mathematics because they have low self-efficacy in learning because learning is oriented to everyday problems (Anggraini & Fauzan, 2020). Contextual approaches are also included in effective approaches to achieve learning objectives. One of them is by incorporating a contextual approach into the culture or local wisdom of the student's environment.

Ethnomathematics is an approach that involves culture with mathematical concepts so that it can be a learning material in schools (Muhammad, 2023). Ethnomathematics studies local culture or historical heritage that has a connection with mathematics learning (Iraratu et al., 2021). So it can be concluded that ethnomathematics can be interpreted as a process of investigating the study of mathematics contained in a particular culture or community group. Ethnomathematics can be done using contextual learning principles, namely learning by utilizing objects around (Setiana & Ayuningtyas, 2018). Previous research states that ethnomathematics can be an innovative and interesting learning alternative because of its contextual meaning (Ramadhani et al., 2023). So ethnomathematics is a learning approach that involves the local culture around students which can build innovative, interesting, contextual, and meaningful learning including batik (Yolanda & Putra, 2022).

Lifting batik culture, especially batik motifs, can help students understand reflection material (mirroring) of an object (Pitri et al., 2023) and reflection of lines on cartesian coordinates (Novrika

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et al., 2016). Batik fabric motifs can be an alternative learning process for students (Sudirman et al., 2017). Learning with good fabric motifs can also improve. One type of batik with diverse motifs that can support the learning of mathematics, especially the material of geometry transformation is batik Parang Teja. This is because the diverse motifs in Parang Teja batik can be a bridge to understanding the concept of geometric transformation material. In the motif of Parang Teja batik there are elements of geometric transformation including translation and reflection. Through the ethnomathematics learning approach using the Parang Teja batik motif, there is a need for innovative learning that can accommodate this learning approach.

Innovative learning can be supported with the help of learning technology. The use of technology helps learners develop in current and future life situations (Samo et al., 2019). Desmos Classroom technology is also defined as technology that can support mathematics learning so that the learning process is more interactive and interesting (Tumanggor & Yahfizham, 2024). Therefore, the integration of Desmos Classroom technology in math learning can create interesting math learning and students can integrate technology in today's digital era.

Some researchs have suggested that ethnomathematics-based mathematics learning is effective in improving students' understanding, as evidenced by its effect on the ability to identify, translate, understand, and solve mathematical problems (Pambudi & Najibufahmi, 2024). Another study has conducted research testing desmos on geometric transformation material and concluded that desmos is able to improve students' understanding abilities, researchers also concluded that learning using desmos is better than conventional strategies (Pambudi & Najibufahmi, 2024).

Based on the description and review of previous research, the researcher plans for research aimed at developing ethnomathematics-based teaching materials on the parang teja batik motif for learning geometry transformation material that focuses on translation and reflection with the help of Desmos Classroom technology media. Teaching materials that will be designed innovatively are interesting and contextual for students. The use of the parang teja batik motif aims to support teaching materials which are expected to be a bridge to contextual learning so that students can understand.

METHOD

This research is a development research or Research and Development (R&D). R&D is a research method that creates new product innovations or develops existing products to achieve specific learning objectives (Muqdamien et al., 2021). This research focuses on creating innovative open material products on the topic of geometric transformation, subchapter translation and reflection with an ethnomathematics approach. The data collection stage in this study was carried out through literature study and distributing questionnaires given to students as well as media expert validators and material experts. While the data analysis process in this study uses a qualitative descriptive data

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analysis approach, which includes collecting and interpreting numerical data at the development stage through questionnaires given to media expert validators and material experts. This research has not yet reached the implementation stage, but only reached the development stage whose results have been tested on a limited basis to 21 mathematics education students with the learning process using learning devices.

The development research model used in this study is the ADDIE model. This model consists of five basic steps, namely Analysis, Design, Development, Implementation, and Evaluate. The ADDIE model is a learning model that is often used by educators to design educational programs (Spatioti et al., 2022). The ADDIE design includes the stages of Analysis, Design, Develop, Implementation, and Evaluate (Sugiyono, 2015). These stages are represented in Figure 1.

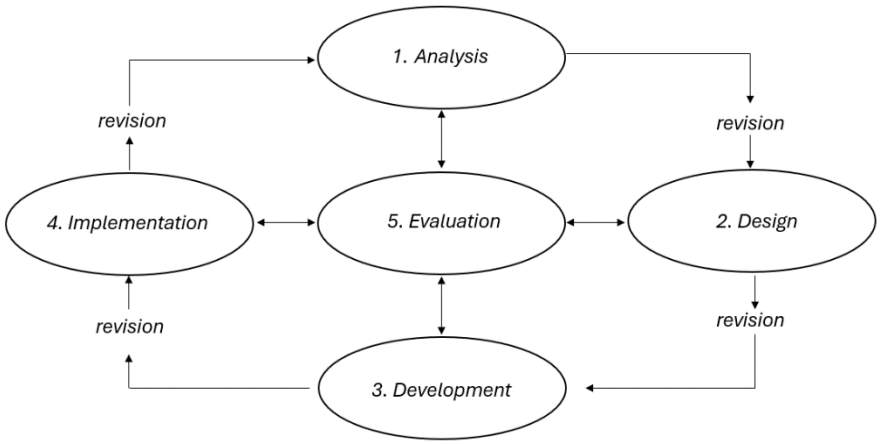

Figure 1. ADDIE Model

Analyze

The analysis stage includes the initial stage which contains problem identification and needs analysis (Nugraha et al., 2015) The analysis stage considers the research objectives. The needs analysis stage is carried out to determine the needs of the audience by comparing what students already know and what students do not know (Peterson, 2003). This research will discuss the development of teaching materials so that a literature review related to culture in Indonesia and material analysis on the current relevant curriculum are needed.

Design

At the design stage, researchers began to develop ethnomathematics-based teaching materials that had been studied by previous researchers. The process carried out is the preparation of teaching material formats, selection of learning support technology, and selection of learning presentation models tailored to the independent curriculum until ethnomathematics-based teaching materials are obtained in electronic form. Teaching materials include several dynamic activities, namely 1)

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Introduction to Parang Teja batik, 2) Stimulus, 3) Translational Geometry Transformation Activity, 4) Reflection Geometry Transformation Activity, 5) Peer assessment, 6) Competency test, 7) Learning reflection.

Develop

The development stage validates teaching materials, refining the results of suggestions from validators. Validation is carried out by experts to validate teaching materials and learning media. The criteria for the feasibility level of teaching materials and media are listed in Table 1 (Suharsimi, 2009).

Table 1. Criteria for the Level of Feasibility of Materials and Media

No	Score	Category
1.	< 21%	Very Unfit
2.	21% – 40 %	Not Feasible
3.	41% – 60 %	Decent Enough
4.	61% – 80 %	Feasible
5.	81% – 100 %	Very Decent

Implementation

This research has not yet reached the implementation stage, but has only reached the development stage whose results have been tested on a limited basis to 21 mathematics education students. From this development, a teaching material product is produced which will be ready to be tested / implemented directly to students. The reason for the limited trial was the limited time of the research and the incompatibility of the research time with the school agenda. The implementation steps are as follows: 1) distributing teaching materials that have been designed 2) opening the class to carry out learning 3) the subject opens the Desmos Classroom activity with the code available on the teaching material 4) the researcher opens the activity and students carry out all teaching material activities 5) the researcher closes the learning 6) the subject gives suggestions about the learning that has taken place. After implementation, subjects are welcome to provide suggestions and feedback on the application of the teaching material development on the Google Form link.

Evaluate

The evaluation stage is the final stage of this research, namely evaluating the performance and success of Desmos Classroom media products that have been made based on the ability of the test subjects, the effectiveness of the product, and the results of the researchers' observations of the test subjects' responses. Teaching materials have been validated and refined before the limited implementation stage and declared feasible to use.

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RESULTS AND DISCUSSION

Analyze

The first stage in this research is a literature review analysis used to examine in depth the mathematical elements of Indonesian culture. Parang Teja batik culture has mathematical elements that have elements especially in Geometry material (Sudirman et al., 2018). Based on the literature review, the researchers studied that Parang Teja batik can be a bridge for the learning process of Geometric Transformation material. Further literature searches related to Geometric Transformation material, especially the concepts of translation and reflection to find the suitability of translation and reflection material in the Merdeka Curriculum with the cultural approach of the Parang Teja batik motif. Geometric Transformation material is contained in the Merdeka Curriculum in phase D with Learning Outcomes (PK): Learners can perform single transformations such as (reflection, translation, rotation, and dilation) of points, lines, and flat shapes on the cartesian coordinate plane and use them to solve problems (Kemendikbudsaintek, 2024).

Batik parang teja has a tumpal motif that resembles triangular geometric shapes that are lined up and facing each other, thus supporting this research on Geometric Transformation material on the concepts of Translation and Reflection. This Geometric Transformation material is still relevant to the competencies of the current education curriculum, namely the Merdeka Curriculum stage D for grade XI junior high school students who follow CP and in accordance with the learning objectives, namely 1) interpreting the meaning of translation and reflection, 2) describing translation and reflection using cartesian coordinates, 3) applying translation and reflection in Indonesian culture, namely the Parang Teja batik cloth motif. Therefore, researchers chose the Parang Teja batik motif as an ethnomathematics object in the teaching materials to be developed because ethnomathematics in Parang Teja batik has the potential to be effectively integrated into the curriculum as part of teaching materials.

Design

In the Translational and Reflection Geometry Transformation activity, learning media is used, namely Desmos Classroom. In this activity, there are several slides for concept development. The slides consist of independent exploration activities with the graph feature on Desmos Classroom, opinion activities on the results of their observations using the graph feature and free response, and activities to conclude the meaning of translation and rotation with the free response feature. The appearance of the cover of the teaching material is as Figure 2.

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Figure 2. Cover of Teaching Materials

Teaching materials are also accompanied by learning media, researchers design learning media using Desmos Classroom technology. Figure 3 shown the initial appearance of the learning media.

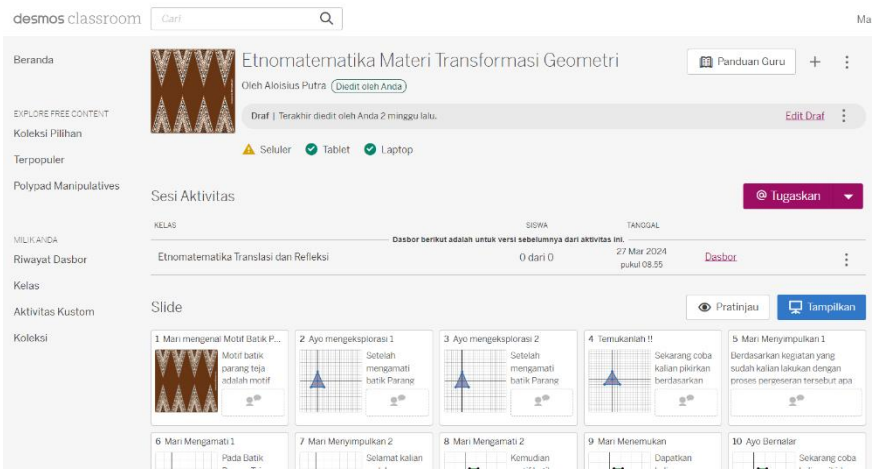

Figure 3. Desmos Classroom View

Development

The material validation results consist of four aspects of assessment which include language aspects, content aspects, presentation aspects, and ethnomathematics aspects. The validator's assessment is represented in Table 2.

Table 2. Material Validation Data

Assessment Aspect	Validator	Scorer	Maximum Score	Percentage (%)
Language Aspect	Validator 1	13	15	87
	Validator 2	7	15	47
Content Aspect	Validator 1	15	15	100
	Validator 2	10	15	67
Presentation Aspect	Validator 1	24	25	96
	Validator 2	18	25	72
Ethnomathematics Aspect	Validator 1	15	15	100
	Validator 2	11	15	73
Total				641
Average				80
Category				**Feasible**

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The validator also provided suggestions related to language, presentation content, and ethnomathematics aspects aimed at improving the correctness of the designed material. The validator feedback given is as follows: first, the lack of using the context of Parang Teja batik in the activity of finding the concept of translation and reflection, the context is only given in the "Mari Mengenal Batik Parang Teja" activity and is not used in subsequent activities. Therefore, improvements were made as shown in Figure 4.

Before After

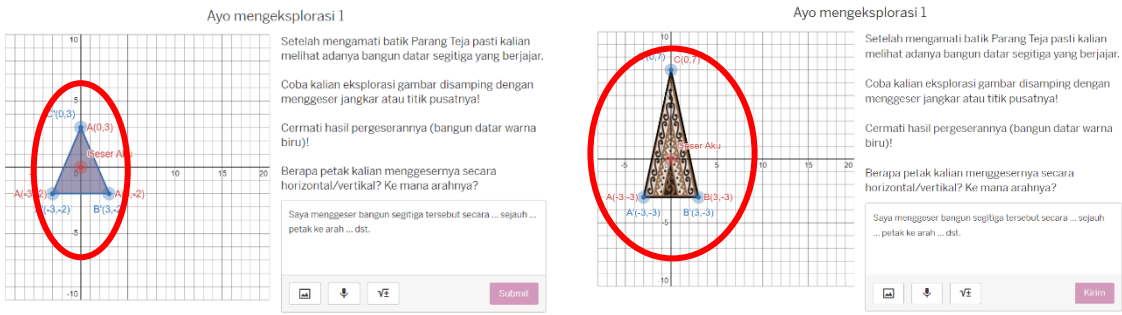

Figure 4. Feedback 1 Material Improvement

Second, the dynamics activity written on page 2 does not match what is written on the "Aktivitas Dinamika" sheet.

Before After

Figure 5. Feedback 2 Material Improvement

Furthermore, the results of media validation consist of three aspects of assessment which include aspects of the suitability of using learning media, aspects of presentation techniques, and ethnomathematics aspects. The validator's assessment is represented in Table 3.

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Table 3. Media Validation Data

Assessment Aspect	Validator	Scorer	Skor Maksimal	Presentation (%)
Aspects of the suitability of using learning media	Validator 1	13	15	87
	Validator 2	8	15	53
Aspects of presentation technique	Validator 1	13	15	87
	Validator 2	8	15	53
Aspects of ethnomathematics	Validator 1	9	10	90
	Validator 2	6	10	60
Total				430
Average				72
Category				**Feasible**

Media-related input from validators includes input for the suitability of using learning media, aspects of presentation techniques, and aspects of ethnomathematics which aim to improve the effectiveness of the media presented. The input given is as follows: first, on slide 10 it is necessary to avoid double questions.

Before After

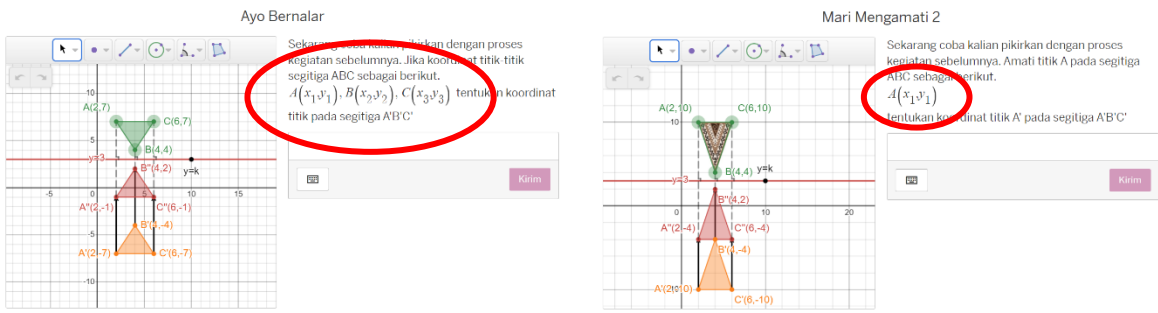

Figure 6. Feedback 1 Media Improvement

Secondly, input related to the triangle used for understanding concepts raised from batik culture, it should be noted that the batik parang teja is an isosceles triangle not an equilateral triangle.

Before After

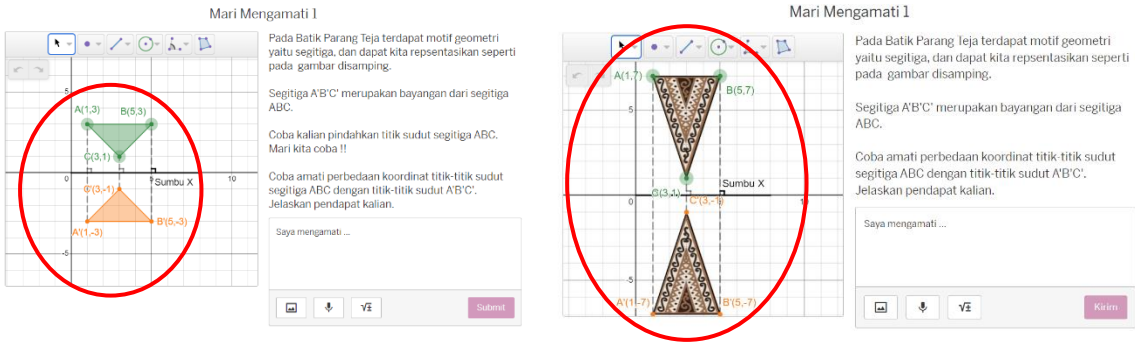

Figure 7. Feedback 2 Media Improvement

Implementation

Feedback from the majority of subjects wrote that the activities were interesting, the learning media was able to allow students to construct their understanding, and overall, the learning design was

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good. Subjects also provided suggestions for learning implementation which are summarized as follows: 1) teaching materials for one meeting are considered too dense so it is necessary to design teaching materials by adjusting the time of students' learning hours so that learning objectives can be achieved, 2) in the finding activity on slide 4 Desmos Classroom, questions need to be made in stages from the experimental process of observing points to the mathematical form of translation, 3) cultural elements in learning can be reproduced more to make ethnomathematics-based learning more meaningful. Based on the input from the subject, improvements are needed to Desmos so that it can be implemented effectively in the field. The revised learning tools can be used by educators optimally so that learning can take place in accordance with the predetermined objectives.

Evaluate

After conducting the implementation stage, there were several inputs from the research subjects, which have been explained at the implementation stage, there needs to be improvements that must be made to support learning media that are in accordance with the needs of students. The input from the majority of subjects wrote that the activities were interesting, the learning media was able to construct students' understanding, and overall the learning design was good. Subjects also provided suggestions for learning implementation which are summarized as follows: 1) on slide 4 of Desmos Classroom, do not immediately give questions with general form answers directly, it can be added to the previous slide, namely related to questions that direct students to answer according to the context of the experiment or answers in the form of numbers, not mathematical forms, 2) cultural elements in learning can be reproduced so that ethnomathematics-based learning becomes more meaningful.

Based on the evaluation of the implementation stage, the following improvements were made: 1) Change the question sentence on slides 4 and 5.

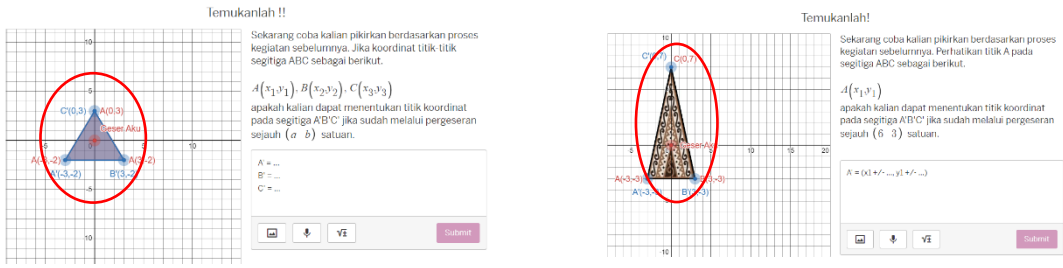

Figure 8. Slide 4 improvement input on Desmoss Classroom

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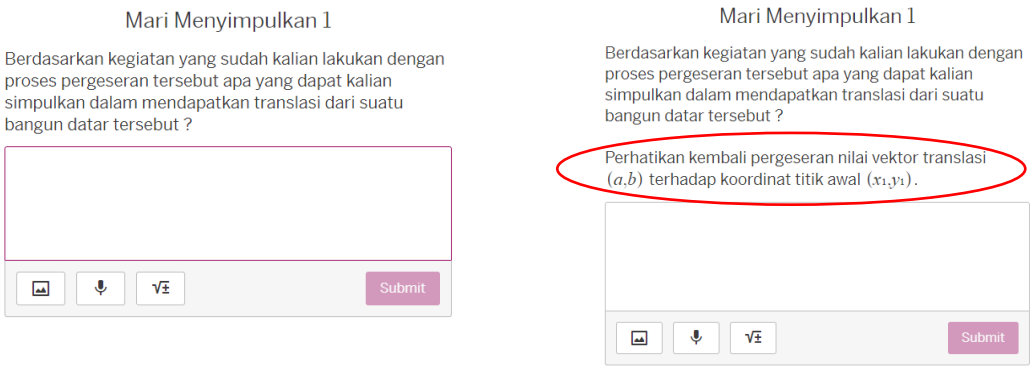

Figure 9. Slide 5 improvement input on Desmoss Classroom

After conducting the evaluation, the following is the Desmos Classroom link https://bit.ly/DesmosClassroomTransformasiGeometriBatikParangTeja that can be used and here is a link to teaching materials as a guide for teaching in the classroom https://bit.ly/BahanAjarTesselasiBatik

CONCLUSION

Based on the results of research on the development of Geometric Transformation teaching media using an ethnomathematics approach assisted by Desmos Classroom, it can be concluded that teaching materials are suitable for use after being developed with the ADDIE model. The analyze stage is the process of analyzing needs, the design stage is the stage of designing teaching materials based on the results of the analysis, the development stage is the development stage based on the results of expert validation, the implementation stage is the process of implementing teaching materials to research subjects, and the evaluate stage is the stage of evaluating teaching materials based on the results of implementation. After implementing the ADDIE model, it was found that the teaching materials developed were included in the feasible category with a material feasibility percentage of 80% and a media feasibility percentage of 72%. Several processes of improving teaching materials and Desmos Classrooms media were carried out based on input from experts, including adding the use of the Parang Teja batik context in each activity to find the concept of translation and reflection, improving the writing of dynamic activities that are not in accordance with the topics written on each page, avoiding multiple questions, paying attention to the shape of the Parang Teja batik triangle is an isosceles triangle not an equilateral triangle. Based on the results of the questionnaire, the subject also stated that the teaching materials were able to construct students' understanding independently and were interesting for students.

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